

meeting PM-NO_x limits through numerical feasibility analysis



With ever tightening emission legislation, the portfolio of in-cylinder and aftertreatment solutions available to engine designers is increasing. At the concept stage, carrying out feasibility analysis is becoming an ever more utilised 1st iteration.

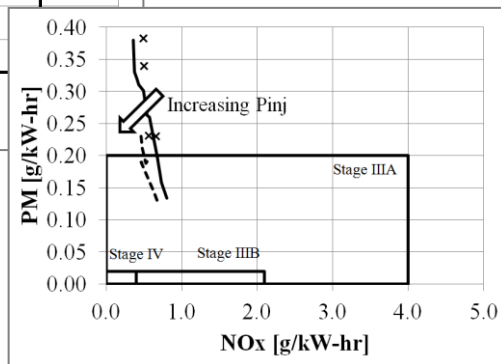
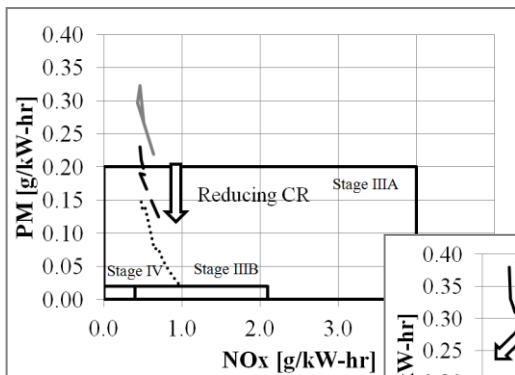
“Physics-based” analysis tools can be considered more “predictive” than equivalent empirically based methods, so can be applied with more confidence to new designs and novel concepts.

THE CHALLENGE

To simulate a CIDI engine and meet the next generation of Tier 4 NO_x/PM emission targets through numerically led design improvements.

PM-NO_x TRADE-OFF ANALYSIS

A series of computations using srm engine suite were carried out. Firstly the model was calibrated and a successful blind test was carried out. Next the compression ratio, EGR rate, injection strategy and injection pressure were varied with the objective of meeting the Stage IV emission targets.



Typical engine design configuration optimization trends for PM and NO_x in heavy duty IC engines

More details of this analysis are published in the SAE paper 2013-01-0308.

SUMMARY

- A Tier 4 CIDI engine was simulated
- A blind test of the model was carried out to confirm the model was robust
- Key design parameters i.e. Compression ratio, injection pressure were manipulated to meet PM-NO_x emission standards

Result of blind test analysis –P-CAD profiles over injection timing sweep

